Shape transitions and triaxiality in neutron-rich Y and Nb isotopes

Y.X. Luo[1,2], J.O. Rasmussen[2], J.H. Hamilton[1], A.V. Ramayya[1], J.K.Hwang[1], S.J. Zhu[1], P.M. Gore[1], S.C. Wu[2], I.Y. Lee[2], P. Fallon[2], T.N. Ginter[2], A.V. Daniel[1], M.A. Stoyer[2], R. Donangelo[2], and A. Gelberg[3]

[1] *Physics Department, Vanderbilt University, Nashville, TN 37235, USA*

[2] *Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720*

[3] *Inst. fuer Kernphysik, Universitaet zu Koeln, Germany*

Intensive studies of shape transitions and shape coexistence have been carried out in neutron-rich even-even nuclei with A~100[1, 2]. Onset of deformation, identical bands, shape evolution and coexistence including triaxiality are observed in neutron-rich Sr-Zr-Mo isotopes. Recently, triaxial deformation in Mo and axially-symmetric shape in Zr isotopes were suggested by Hua et al.[3]

However, there is a lack of data for odd Z nuclei. Following our work on Rh (Z=45)[4] and Tc (Z=43)[5] we are now focusing our attention on Y (Z=39) and Nb (Z=41) isotopes. New level schemes of $^{99, 101}$Y and $^{101, 105}$Nb are proposed based on our fission gamma data accumulated with Gammasphere in 2000. Bands of $\pi 5/2^+[422]$, $\pi 5/2^-[303]$ and $\pi 3/2^-[301]$ are observed and extended to show spectroscopic information concerning nuclear shapes in this important 0dd-Z region.

It is suggested that quadrupole deformation peaks at N = 60 in Y (Z=39) isotopic chain and at N = 62 in Nb (Z=41) chain. The deformation decreases with increasing Z, following the same trend in neighboring even-Z nuclei.

Very small signature splitting is observed in Y isotopes, in contrast to the very large ones in Tc and Rh isotopes[4, 5] (see Fig. 1), the latter being attributed to the triaxial deformation in Tc and Rh isotopes. A pronounced difference in $J^{(1)}$ and $J^{(2)}$ is also observed between Y and Tc, Rh isotones, similar to what observed in Zr and Mo[3]. The difference in band crossing frequencies between Zr and Mo isotopes were accounted for by triaxial degree of freedom in Mo and axially symmetry shape in Zr isotopes.

A band built on an excited $11/2^+$ state with excitation as high as 1654.7 keV in ^{99}Y predominantly feeds the $7/2^+$ state of the yrast band, in contrast to the low excitation and very small E2 strength in Rh and Tc cases [4, 5]. The latter was attributed to triaxiality in Rh and Tc isotopes[4, 5].

All the observations provide evidences of an axially-symmetric shape in Y isotopes. However, Nb isotopes, having intermediate values, are transitional regarding γ deformation.

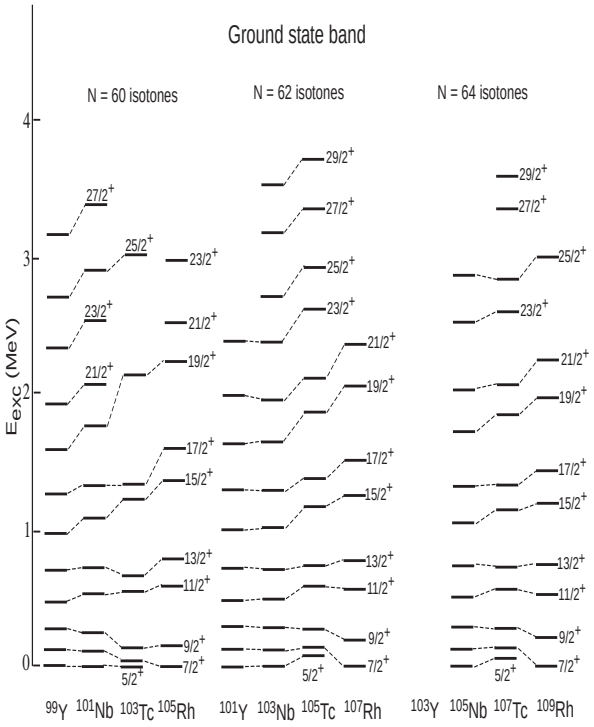

FIG. 1: Level systematics of ground state band in N = 60-62 isotones with odd Z = 39 – 45.

REFERENCES

[1] J. Skalski et al., Nucl.Phys. A**617**, 282(1997).

[2] J.H. Hamilton, Treatise on Heavy Ion Science,Vol. 8, Allan Bromley, Ed., New York, Plenum Press, (1989), p. 2.

[3] H. Hua, et al., Phys. Rev. C**69**, 014317(2004).

[4] Y.X. Luo et al., Phys. Rev. C**69**, 024315(2004).

[5] Y.X. Luo et al., to be published.